CLAIMS

1. A negative electrode material for a lithium battery characterized by comprising a carbonaceous negative electrode active substance having a specific surface area of 1 m^2/g or more, a binder formed of styrene-butadiene rubber and a carbon fiber having a fiber diameter of 1 to 1,000 nm.

2. The negative electrode material for a lithium battery as claimed in claim 1, wherein the binder formed of styrene-butadiene rubber is in the form of fine particles having an average particle size of 10 to 500 nm.

3. The negative electrode material for a lithium battery as claimed in claim 1, wherein the amount of the carbon fiber is 0.05 to 20 mass% and the amount of the binder formed of styrene-butadiene rubber is 0.1 to 6.0 mass%, on the basis of the total amount of the carbonaceous negative electrode active substance, the binder, and the carbon fiber.

4. The negative electrode material for a lithium battery as claimed in claim 1, which further comprises a thickener.

5. The negative electrode material for a lithium battery as claimed in claim 4, wherein the amount of the thickener is 0.1 to 4 mass% on the basis of the total amount of the carbonaceous negative electrode active substance, the binder, the carbon fiber and the thickener.

6. The negative electrode material for a lithium battery as claimed in claim 4, wherein the thickener is carboxymethyl cellulose.

7. The negative electrode material for a lithium battery as claimed in claim 1, wherein a negative electrode formed of the electrode material exhibits a specific resistance of 0.5 Ωcm or less at 25°C.

8. The negative electrode material for a lithium battery as claimed in claim 1, wherein the carbon fiber is a graphite carbon fiber which has undergone thermal treatment at 2,000°C or higher.

9. The negative electrode material for a lithium battery as claimed in claim 1, wherein the carbon fiber is a graphite carbon fiber having a surface to which an oxygen-containing functional group has been introduced through oxidation treatment.

10. The negative electrode material for a lithium battery as claimed in claim 1, wherein the carbon fiber is a graphite carbon fiber containing boron in an amount of 0.1 to 100,000 ppm.

11. The negative electrode material for a lithium battery as claimed in claim 8, wherein the graphite carbon fiber has an average interlayer distance (d_{002}) of a (002) plane of 0.344 nm or less as measured by X-ray diffractometry.

12. The negative electrode material for a lithium battery as claimed in claim 1, wherein the carbon fiber has a structure with a hollow space.

13. The negative electrode material for a lithium battery as claimed in claim 1, wherein the carbon fiber contains a branched carbon fiber.

14. The negative electrode material for a lithium battery as claimed in claim 1, wherein the carbonaceous negative electrode active substance contains Si.

15. The negative electrode material for a lithium battery as claimed in claim 1, wherein the carbonaceous negative electrode active substance is a non-graphite carbon material, and the layer of the compound comprising a negative electrode active substance, binder and electrically conductive additive exhibits a bulk density of 1.5 g/cm^3 or more.

16. The negative electrode material for a lithium battery as claimed in claim 1, wherein, before the electrode material is formed into an electrode, the carbonaceous negative electrode active substance is in the form of carbonaceous particles satisfying the following requirements:
(1) average roundness as measured by use of a flow particle image analyzer is 0.70 to 0.99; and
(2) average particle size as measured by laser diffractometry is 1 to 50 μm.

17. The negative electrode material for a lithium battery as claimed in claim 1, wherein the carbonaceous negative electrode active substance contains a graphite carbonaceous material in an amount of 50 mass% or more.

18. The negative electrode material for a lithium battery as claimed in claim 17, wherein the graphite material contains boron.

19. The negative electrode material for a lithium battery as claimed in claim 1, wherein, before the electrode material is

formed into an electrode, the carbonaceous negative electrode active substance is in the form of carbonaceous particles containing, in an amount of 50 mass% or more, graphite particles satisfying the following requirements:

(1) average roundness as measured by use of a flow particle image analyzer is 0.70 to 0.99; and

(2) average particle size as measured by laser diffractometry is 1 to 50 μm.

20. The negative electrode material for a lithium battery as claimed in claim 17, wherein the graphite carbonaceous material is in the form of carbonaceous particles containing, in an amount of 50 mass% or more, graphite particles satisfying the following requirements:

(1) C_0 of a (002) plane as measured by X-ray diffractometry is 0.6900 nm or less, La (the size of a crystallite as measured along the a-axis) is greater than 100 nm, and Lc (the size of a crystallite as measured along the c-axis) is greater than 100 nm;

(2) specific surface area is 1.0 to 10 m^2/g;

(3) true density is 2.20 g/cm^3 or more; and

(4) laser Raman R value (the ratio of the intensity of a peak at 1,360 cm^{-1} in a laser Raman spectrum to that of a peak at 1,580 cm^{-1} in the spectrum) is 0.01 to 0.9.

21. The negative electrode material for a lithium battery as claimed in claim 15, wherein the layer of the compound comprising a negative electrode active substance, binder and electrically conductive additive exhibits a bulk density of 1.7 g/cm^3 or more.

22. A method for producing a composition for forming a negative electrode material for a lithium battery, comprising

adding an aqueous styrene-butadiene rubber dispersion to a carbon fiber/active substance dispersion prepared by dispersing, in an aqueous thickener solution, a carbon fiber having a fiber diameter of 1 to 1,000 nm, a carbonaceous negative electrode active substance having a specific surface area of 1 m^2/g or more; and stirring the resultant mixture.

23. The method for producing a composition for forming a negative electrode material for a lithium battery as claimed in claim 22, wherein the carbon fiber/active substance dispersion is prepared by dispersing a carbon fiber having a fiber diameter of 1 to 1,000 nm in an aqueous thickener solution under stirring; and by adding thereto a carbonaceous negative electrode active substance having a specific surface area of 1 m^2/g or more followed by mixing with stirring.

24. The method for producing a composition for forming a negative electrode material for a lithium battery as claimed in claim 22, wherein the carbon fiber/active substance dispersion is prepared by dispersing a carbon fiber having a fiber diameter of 1 to 1,000 nm in an aqueous thickener solution under stirring; by adding thereto a carbonaceous negative electrode active substance having a specific surface area of 1 m^2/g or more followed by mixing with stirring; and by being regulated using an aqueous thickener solution.

25. The method for producing a composition for forming a negative electrode material for a lithium battery as claimed in claim 22, wherein the carbon fiber/active substance dispersion is prepared by adding, to an aqueous thickener solution, a carbonaceous negative electrode active substance having a specific surface area of 1 m^2/g or more followed by mixing with stirring; and by dispersing a carbon fiber having

a fiber diameter of 1 to 1,000 nm in the resultant mixture under stirring.

26. The method for producing a composition for forming a negative electrode material for a lithium battery as claimed in claim 22, wherein the carbon fiber/active substance dispersion is prepared by dry-mixing a carbon fiber having a fiber diameter of 1 to 1,000 nm with a carbonaceous negative electrode active substance having a specific surface area of 1 m^2/g or more to thereby disperse the carbon fiber in the resultant mixture; and by adding an aqueous thickener solution to the resultant mixture, followed by mixing with stirring.

27. The method for producing a composition for forming a negative electrode material for a lithium battery as claimed in claim 22, wherein the content of the thickener in the aqueous thickener solution is 0.3 to 5 mass%, and the content of the styrene-butadiene rubber in the aqueous styrene-butadiene rubber dispersion is 10 to 60 mass%.

28. The method for producing a composition for forming a negative electrode material for a lithium battery as claimed in claim 22, wherein the thickener is carboxymethyl cellulose.

29. A composition for forming a negative electrode material for a lithium battery, which composition is produced by means of a method as claimed in claim 22.

30. A composition for forming a negative electrode material for a lithium battery, which composition comprises an aqueous thickener solution, wherein carbon fiber having a fiber diameter of 1 to 1,000 nm is dispersed.

31. The composition for forming a negative electrode material for a lithium battery as claimed in claim 30, wherein the content of the thickener in the aqueous thickener solution is 0.3 to 5 mass%, and the amount of the carbon fiber is 0.1 to 10 mass% on the basis of the entirety of the composition.

32. The composition for forming a negative electrode material for a lithium battery as claimed in claim 30 or 31, wherein the thickener is carboxymethyl cellulose.

33. The negative electrode material for a lithium battery as claimed in any one of claims 1 to 21, which is produced by applying the composition for forming the negative electrode material for a lithium battery as claimed in claim 29 onto a metallic collector foil, and drying the thus-applied composition, followed by pressure molding.

34. The negative electrode material for a lithium battery as claimed in claim 33, wherein the metallic collector foil is a copper foil or copper alloy foil having a thickness of 1 to 50 μm.

35. A lithium battery comprising the negative electrode material for a lithium battery as recited in any of claims 1 to 21, 33 and 34.

36. A lithium secondary battery comprising the negative electrode material for a lithium battery as claimed in any of claims 1 to 21, 33 and 34.

37. The lithium secondary battery as claimed in claim 36,

which comprises a non-aqueous electrolyte and a non-aqueous solvent for the non-aqueous electrolyte, which is at least one species selected from the group consisting of ethylene carbonate, diethyl carbonate, dimethyl carbonate, methyl ethyl carbonate, propylene carbonate, butylene carbonate and vinylene carbonate.